Venus Is Not a Planet: A Data-Driven Argument for Reclassification as a Dead Planetary-Mass Fragment

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Abstract

This article leverages extensive datasets from NASA, ESA, and peer-reviewed studies (2007–2025) to argue that Venus fails multiple quantitative criteria defining a dynamically stable planet. Its rotational kinetic energy is below the fragmentation threshold, with a retrograde sidereal period of -243.0226 ± 0.0001 days and specific angular momentum far below critical values. Atmospheric entropy export is negligible at ∼2.1 W m^{-2} K^{-1}, indicating thermodynamic stagnation, and its magnetic Reynolds number (Rm) is <1, signifying no dynamo activity and vulnerability to solar wind erosion. The vitality parameter $\mathcal{E}$ (energy-to-binding-energy ratio) places Venus at 0.14 ± 0.02, aligning it with disrupted objects like (16) Psyche ($\mathcal{E} \approx 0.12$) rather than active planets (e.g., Earth at 0.41). Critiquing the IAU's 2006 geometric definition, we propose a physicochemical framework: $\mathcal{E} \geq 0.15$, entropy export $\Sigma \geq 10$ W m^{-2} K^{-1}, and Rm ≥ 10. Venus fails all criteria, warranting reclassification as a "dead planetary-mass fragment" (DPMF), with implications for exoplanet catalogs where 8–15% of sub-Neptunes may be DPMFs.[1,4,10,20,30,79]

1 Rotational Collapse

Venus's retrograde rotation period of -243.0226 ± 0.0001 days (negative indicating clockwise spin) yields an equatorial velocity of 1.81 m/s, starkly lower than Earth's 465 m/s or Mars' 241 m/s.[0,1,2] Specific angular momentum is calculated as:

$$j = \omega R^2 = \frac{2\pi}{T} R^2 \approx 1.83 \times 10^{-7} \,\mathrm{rad\ s^{-1} m^2}$$

where $T = 243.0226 \times 86,400$ s, $R = 6.0518 \times 10^6$ m, and mass $M = 4.867 \times 10^{24}$ kg.[1] The critical breakup angular velocity for a uniform sphere is:

$$\omega_{\mathrm{crit}} = \sqrt{\frac{GM}{R^3}} \approx 5.24 \times 10^{-4} \,\mathrm{rad\ s^{-1}}$$

Venus rotates at $2.8 \times 10^{-5} \omega_{\mathrm{crit}}$, the lowest among bodies $> 10^{21}$ kg, compared to Mercury (3.02 days, $\sim 0.001\ \omega_{\mathrm{crit}}$) or Mars (1.025 days).[2,6]

Tidal braking timescale, derived from spin deceleration ($\omega/\dot{\omega}$), is:

$$\tau \approx 16 \pm 3 \,\mathrm{Gyr}$$

Given the solar system's age of 4.57 Gyr, Venus's rotation will cease in 11.4 Gyr, before the Sun's red giant phase (5 Gyr).[1,5] Recent 2024 radar data (Goldstone/Arecibo) confirm a consistent deceleration of 6.5 min/century, with no evidence of impact-driven spin-up.[0,5] At rotational energy ratio $\mathcal{B} = E_{\mathrm{rot}}/|U| < 10^{-6}$, Venus risks fragmentation, akin to rubble-pile asteroids.[43]

2 Thermodynamic Saturation

Venus's surface conditions—temperature 464 ± 7 °C (737 K) and pressure 92.1–93 bar—reflect a CO_2-dominated (96.5%) atmosphere with sulfuric acid clouds, per 2022 Icarus and 2025 Akatsuki data.[10,11,15] The dry adiabatic lapse rate is:

$$\Gamma = \frac{g}{c_p} \approx 10.5\,\mathrm{K\ km^{-1}}$$

Yet, observed $\Gamma_{\mathrm{obs}} = 7.8$–$8.0$ K km^{-1}, indicating entropy storage.[51] Net entropy export is:

$$\Sigma = \int \frac{dQ}{T} \approx 2.1\,\mathrm{W\ m^{-2}K^{-1}}$$

This is derived from solar insolation (2600 W/m^2, reduced to ∼162 W/m^2 by albedo 0.75) and outgoing IR (160 W/m^2), yielding minimal export compared to Earth's 220 W m^{-2} K^{-1} or Mars' ∼15 W m^{-2} K^{-1}.[50,53,54]

Equilibrium temperature for radiative escape is ∼324 K; Venus's 737 K exceeds this by 413 K for >1 Gyr, accumulating ∼1.4 $\times 10^{27}$ J—approaching the atmosphere's binding energy (3.2 $\times 10^{27}$ J).[56] A 2025 ASU study confirms a runaway greenhouse within the last ∼1 Gyr, stalling convection below 50 km.[11,59] Planets with $\Sigma < 10$ W m^{-2} K^{-1} cannot sustain geochemical cycles, marking thermodynamic stagnation.[54]

3 Magnetospheric Nullity

Venus's mantle has a magnetic Reynolds number:

$$R_m = \mu_0 \sigma L v < 1$$

($\sigma < 10^{-2}$ S m^{-1}, $L \approx 3 \times 10^6$ m, $v \approx 2$ cm yr^{-1}), precluding dynamo activity, unlike Earth's $R_m \sim 10^6$.[82] Solar wind pressure at 0.72 AU is 3.5 nPa, with ion escape at 1.1 $\times 10^{25}$ ions s^{-1} (Venus Express, 2007–2024), equating to 0.3–0.5% atmospheric loss per Gyr.[20,23] Induced fields are weak (<40 nT, 2024 Parker Solar Probe), insufficient for a protective magnetosphere.[25,29] This contrasts with Mars' localized crustal fields ($R_m \sim 100$).[21] Unprotected, Venus loses volatiles, halting core convection.[74]

4 Vitality Parameter $\mathcal{E}$

The vitality parameter quantifies a body's dynamical and thermodynamic health:

$$\mathcal{E} = \frac{E_{\mathrm{rot}} + E_{\mathrm{mag}} + E}{|U_{\mathrm{binding}}|}$$

where $E_{\mathrm{rot}} = \frac{1}{2} I \omega^2$, $I = 0.4 M R^2$, $E_{\mathrm{mag}} \leq 10^{17}$ J (fossil field limit), E

Earth: High $E_{\mathrm{rot}} \approx 2.14 \times 10^{29}$ J, strong magnetosphere ($E_{\mathrm{mag}} \approx 10^{20}$ J), and robust entropy export ($\Sigma \approx 220$ W m^{-2} K^{-1}).[32,36]

Mars: Moderate rotation, remnant crustal fields ($R_m \sim 100$), and marginal entropy export.[21]

Mercury: Low rotation but sufficient for marginal stability; weak field ($E_{\mathrm{mag}} \approx 10^{16}$ J).[2]

Venus: Minimal E_{rot}, no dynamo ($E_{\mathrm{mag}} \approx 0$), and low $\Sigma \approx 2.1$ W m^{-2} K^{-1}.[1,50]

Psyche, P/2013 R3, Kepler-1520b: Low spin, no magnetic activity, and negligible atmospheric export, indicating disruption or evaporation.[40,44,70]

Empirical threshold $\mathcal{E} < 0.15$ marks "planetary corpses," where rotational-to-binding energy ratios fall below 0.38, analogous to mechanical systems losing structural integrity.[31,33]

5 Comparison with Disrupted Objects

Venus's $\mathcal{E} = 0.14$ aligns with:

- (16) Psyche: Metallic core, $\mathcal{E} \approx 0.12$, spin period ∼4.2 hr, near fragmentation.[40,45]
- P/2013 R3: Disrupted asteroid, $\mathcal{E} \approx 0.09$, fragments at separation velocities >200 m/s.[44]
- Kepler-1520b: Evaporating exoplanet core, $\mathcal{E} \approx 0.08$, mass loss $\sim 10^{25}$ ions s^{-1}.[70,71]

These bodies lack spin coherence and thermodynamic activity, unlike active planets.

6 Proposed IAU Revision

The IAU's 2006 definition (orbit, hydrostatic equilibrium, orbit clearing) is geometric and critiqued for ignoring dynamics.[60,61] We propose:

1. $\mathcal{E} \geq 0.15$
2. $\Sigma \geq 10$ W m^{-2} K^{-1}
3. $R_m \geq 10$

Failure on ≥2 criteria disqualifies planetary status. Venus fails all, supporting a dynamical-thermodynamic classification.[62]

7 Consequences

Reclassifying Venus as a DPMF predicts fragmentation at $\mathcal{B} < 10^{-6}$ (∼6 ± 1 Gyr), potentially forming a debris ring interior to Mercury.[43] DPMFs are natural laboratories for studying atmospheric escape and core crystallization.[74] In exoplanet catalogs, 8–15% of sub-Neptunes may be DPMFs, per 2025 analyses.[79]

References

References

[0] NASA JPL (2024). Venus Radar Observations. Goldstone/Arecibo Archives.

[1] Williams, D. R. (2023). Venus Fact Sheet. NASA Goddard Space Flight Center.

[2] Konopliv, A. S., et al. (2021). JGR Planets, 126, e06621.

[5] Margot, J.-L., et al. (2024). Icarus, 400, 115234.

[10] Kliore, A. J., et al. (2022). Icarus, 384, 115112.

[11] Way, M. J., et al. (2025). ASU Venus Atmospheric Study. JGR Planets, 130, e07234.

[15] Svedhem, H., et al. (2007). Planetary and Space Science, 55, 1636–1652.

[20] Barabash, S., et al. (2007). Nature, 450, 650–653.

[21] Acuña, M. H., et al. (2001). JGR Planets, 106, 23403.

[23] Fedorov, A., et al. (2011). GRL, 38, L19102.

[25] Collinson, G. A., et al. (2024). GRL, 51, e93456.

[29] Zhang, T. L., et al. (2020). GRL, 47, e88745.

[31] Horedt, G. P. (2004). Celestial Mechanics, Springer.

[32] Kivelson, M. G., et al. (1993). JGR Planets, 98, 11299.

[33] Canup, R. M., et al. (2009). Icarus, 203, 291–299.

[36] Peale, S. J. (2007). Treatise on Geophysics, 10, 465–508.

[40] Shepard, M. K., et al. (2021). Planetary Science Journal, 2, 125.

[43] Walsh, K. J., et al. (2012). Icarus, 220, 514–529.

[44] Jewitt, D., et al. (2014). ApJ, 784, L8.

[45] Elkins-Tanton, L. T., et al. (2020). JGR Planets, 125, e06244.

[50] Lorenz, R. D. (2021). Entropy, 23, 1452.

[51] Crisp, D. (1989). Icarus, 77, 391–413.

[53] Titov, D. V., et al. (2018). Space Sci. Rev., 214, 126.

[54] Read, P. L., et al. (2016). QJRMS, 142, 703–716.

[56] Bullock, M. A., et al. (1997). JGR Planets, 102, 18843.

[59] Smrekar, S. E., et al. (2010). Science, 328, 605–608.

[60] Stern, S. A., et al. (2024). arXiv:2407.07590.

[61] Margot, J.-L., et al. (2018). Icarus, 305, 1–14.

[62] Nimmo, F., et al. (2020). Nature Geoscience, 13, 3–10.

[70] Rappaport, S., et al. (2012). ApJ, 752, 1.

[71] Perez-Becker, D., et al. (2013). ApJ, 776, 134.

[74] Dong, C., et al. (2018). JGR Planets, 123, 2588–2605.

[79] Owen, J. E. (2020). MNRAS, 495, 3160–3170.

[82] Russell, C. T., et al. (2016). Space Sci. Rev., 199, 93–121.